

## Course syllabus and information

### Course information

Biochemistry and Molecular Biology 461 (BMB461) - Advanced Biochemistry I

9:10-10:00 a.m.; MWF

C102 Wilson Hall

Fall semester 2017

### Contact Information

Instructor Information	Lectures	Office and Office Hours
<b>Dr. Kevin Haudek</b> <b>Course coordinator</b> Phone: 353-4377 <a href="mailto:haudekke@msu.edu">haudekke@msu.edu</a> (must include "BMB461" in subject line)	18-28	219 Biochemistry Bldg. Mondays 2-3 p.m. Tuesdays 10-11 a.m. or by email appointment
Dr. Charles Hoogstraten <a href="mailto:hoogstr3@msu.edu">hoogstr3@msu.edu</a> (must include "BMB461" in subject line)	1-17	302D Biochemistry Bldg Mondays 10:30-11:00 a.m. Thursdays 1-2:30 p.m. or by email appt.
Dr. Daniel Ducat <a href="mailto:ducatdan@msu.edu">ducatdan@msu.edu</a> (must include "BMB461" in subject line)	29-39	206 Plant Biology Laboratory Wednesdays 11 a.m. – 1 p.m. Or by email appt.
Siobhan Cusack <a href="mailto:cusacksi@msu.edu">cusacksi@msu.edu</a>	Teaching Assistant	Reviews: A158 Plant and Soil Sciences Mondays 6-7 p.m. Wednesdays 4-5 p.m.

### Course Materials

All course materials are used in BMB462 as well.

#### Required

- Nelson, D.L. and Cox, M.M. Lehninger Principles of Biochemistry, 7<sup>th</sup> ed. (2017). W.H. Freeman, New York. 1172 pages.
- Access to Sapling Learning ([www.saplinglearning.com](http://www.saplinglearning.com)); an online homework system integrated with an electronic version of the textbook.

Using the older version of the textbook is an option, but if you elect to do so, you are responsible to match the required reading pages/sections appropriately. Alternatively, you may elect to purchase an electronic version of the textbook directly from the publisher.

- i>clicker remote

## *Optional*

The study guide associated with this textbook (*The Absolute, Ultimate Guide to Lehninger Principles of Biochemistry: Study Guide and Solutions Manual* by Marcy Osgood and Karen Ocorr) is an optional resource for this course, but many students have found it helpful in the past.

## **Course Objectives**

BMB 461 is the first semester of the undergraduate series, BMB 461-462, which provides students with an introduction to biochemistry at the advanced undergraduate level. It is designed primarily for students majoring in Biochemistry or closely related field. BMB 461 is a three credit course that reintroduces basic biochemistry concepts including protein structure and function and focuses on carbohydrate and energy metabolism. The following topics will be discussed during this term:

- Buffers, pH
- Protein Structure
- Protein Purification
- Protein-Ligand Binding
- Enzyme Catalysis and Mechanism
- Enzyme Kinetics
- Carbohydrates
- Glucose Metabolism
- Pentose Phosphate Pathway
- Glycogen metabolism and regulation
- Citric Acid Cycle, Glyoxylate Cycle
- Electron Transport, Oxidative Phosphorylation
- Photosynthesis

For each of these topics you will be expected to apply basic biochemical principles to explain biological systems and processes and predict how alterations will impact these systems or processes.

## *Course Expectations of Students*

BMB461 is a rigorous, fast-paced, advanced biochemistry course. Students that complete the course routinely comment that it is one of the most challenging and rewarding classes at MSU. Habits of previously successful students include studying before or after every lecture, completing homework assignments regularly before the posted deadline, forming study groups and attending review sessions. By examining the textbook and course schedule, you will find that the course covers a lot of material each lecture and week. Be forewarned that academic success in this course will likely take a large amount of effort. The instructors are aware of the challenging nature of this course and have devised a course structure to accommodate these challenges (see appropriate sections below for specifics). For example, we enforce weekly homework deadlines to encourage you to keep up with the course content. The grading scale for each grade level is already lowered to accommodate the difficulty of exams and align with past semester performances of this course. Some notecards and calculators are permitted on exams in order to assist you with challenging exam questions. These aspects of the course are intended to help you be successful in this course. We encourage you to prepare yourself for success by devoting the required effort and time necessary for this course.

## **Assessments**

Your grade in BMB 461 will be determined by your performance on the following assessments and weighted by the percentage indicated:

Assessment	Weight	Date or information
Exam I	19%	
Exam II	19%	
Exam III	19%	
Final exam (Exam IV + cumulative portion)	28%	
In class clickers	5%	Used during every lecture with each day weighted equally; drop lowest 5 scores at end of semester
Online homework	5%	Weekly assignments; drop lowest 2 scores at end of semester
Clicker exercises	5%	Eight total over semester; drop lowest 2 scores at end of semester

Additional information about each of these assessments is given below. A total of 0.5% bonus can be earned for completion of optional online quiz and course survey at the beginning and end of the course. The purpose of the extra credit is to give you the opportunity to ensure that if you are within 0.5% of a cutoff for a particular grade for the course that you will earn the higher grade. Please check D2L during the first and last week of class for these optional assessments. No other bonus opportunity or extra credit is offered in this course.

### *Exams*

Exams will contain a mixture of multiple choice, true/false, calculation and free response questions at the instructor's discretion. Each exam contributes to your final course score based on the percentage of indicated above. Exam answer sheets will be provided for all students. Midterm exams will be held in the same room and class time as lectures. Check the university's final exam schedule for details on the final exam location, day and time.

To ensure fairness, we have developed a set of rules. You will enter the room through the specified door(s) and will be assigned to a seat by the instructor or test proctor. Once you are in the room, refrain from talking to your classmates. You must not open the exam until instructed to do so. You will get warnings approximately 15 min and 5 min prior to the end of the exam. Filling in any part of the exam after time has been called is considered cheating and will be dealt with accordingly! When finished, you should put all portions of the exam into the appropriate boxes at the front of the room. You should not talk until you have left the room and/or all of the exams are collected. A copy of the exam with key will be posted when grades are available. Deadlines for reviewing your exam for errors will be given after each exam.

Calculators without Wi-Fi capabilities *will be allowed* on all exams. Calculators with Wi-Fi capabilities, cellphones, and other Wi-Fi devices *may not be used* during the exams. To encourage higher order learning, you may bring one handwritten, double-sided 4 in. x 6 in. notecard to the exams with notes or

equations you deem important. You will be provided with the proper notecard in the week preceding an exam by the instructor. You must use the notecard provided to write your exam notes. The notes must be hand written (i.e. not typed or photocopied), and you must prepare your own note card. Thus, exams will de-emphasize simple memorization of facts. Material expected to be memorized will be covered on the Clicker Check-up Exercises. However, you should realize that your note sheets are limited in size and that there is a tradeoff between the amount of material written on those sheets and your ability to efficiently locate it during exams. A well-organized note sheet is a supplement to a solid understanding of the material rather than a replacement for it.

### *In class clickers*

This course will use i-clickers during lecture both to assess your knowledge of some basic course content and to facilitate active learning. Clickers may be registered through D2L; instructions are posted there. If you do not register your clicker before the first midterm exam, you will not receive credit for previous clicker questions. *There are no make ups for points associated with clickers, for any reason.*

During a typical lecture you will have one or more opportunities to answer questions using the clicker. You will receive 9/10<sup>th</sup> of a point for sending in any answer and an additional 1/10<sup>th</sup> of a point for sending in the correct answer. Some questions are designed to generate discussion and may not have a single correct answer. In this case, you will receive one point for any answer. At the end of the semester your lowest five days will be dropped from your grade. Because of this, you can miss class occasionally for emergencies, religious days, or other commitments without seriously impacting your clicker scores.

Clicker points for the entire semester are worth 5% of your final grade. It is your responsibility to understand the feedback lights on your clicker and verify that your answers are received. It is also your responsibility to check your clicker grade in D2L on a regular basis to verify that your points are being recorded correctly. It is your responsibility to bring your clicker to class each day and if you forget to bring your clicker or miss class for any reason, you will receive no points for that day. You must attend class and use your clicker to receive points: having a friend bring your clicker is a breach of academic integrity and will be treated as such. If you need to replace or re-register your clicker or there are problems with your clicker grade in D2L, please notify the TA immediately.

### *Clicker "Check-up" Exercises*

There will be eight clicker Check-up exercises during the semester, scheduled as indicated on the course schedule. These Check-up Exercises consists of several clicker questions give in succession at the beginning of a class period. In general, these assignments will be based on material you are expected to memorize, such as amino acid structures and abbreviations. The material in each Check-up exercise will be explicitly identified in class or in D2L prior to the exercise. Correct response given during Check-up exercises are awarded a point; incorrect answers are awarded zero points. Your score for each exercise is the total number of question you answered correctly. During the Check-up exercises you will not be allowed to use notes, books, calculators or talk with classmates or instructors. Check-up questions do not represent the types of questions you can expect on exams. Your two lowest scores for Check-up exercises will be dropped at the end of the semester. The remaining Check-up exercises will be worth 5% of your final grade.

### *Online homework*

Homework for BMB 461 is delivered through SaplingLearning ([www.saplinglearning.com](http://www.saplinglearning.com)). Information about how to register for this site and find the correct course will be delivered during the first

week of class. Make sure to follow registration instructions closely. These homework assignments covers some of the key concepts you need to know but are not designed to be exhaustive.

The homework problems over the course of the entire semester are worth a total of 5% of your final grade. There will be a homework assignment due each week. Most of the time, the due date will be on Monday night with the exception of exam weeks, when the due date will be adjusted. It is your responsibility to check SaplingLearning regularly to find when each assignment is due. At the end of the semester, your lowest two homework scores will be dropped. Your average percentage correct on each of the remaining assignments unit will be used to determine what percentage you earn for your overall homework grade. Because we are dropping some of your homework scores, there will be no deadline extensions or make-up points offered for any reason. This includes, but is not limited to, illness, technical/computer issues, vacations, etc.

You are encouraged to work together on homework problems and help each other learn how to solve these problems but you must log on and solve your own homework problems to receive credit. Posting or sharing of homework answers, at any website, is not allowed, is a breach of academic integrity, and will be treated as such.

There may also be optional homework assignments that will neither be collected nor graded, but completing them will help you prepare for the exams. There are also questions in the textbook at the end of each chapter, and you should incorporate these questions into your studies. The answers to these questions are provided in the back of the book. Working in groups on all of the optional problem sets is encouraged as a highly valuable study strategy.

## **Make-up Policy**

There will be no makeup or adjustments to clicker scores or online homework for days you miss class or deadlines, except in the case of an unexpected, severe and extended illness. Each of the assignments (e.g. clickers & homework) has a few low scores dropped at the end of the semester to address occasional student absences (for any reason). Students do not need to provide documentation in order to receive these dropped scores. In the case of an extended (>7 day) illness, students must notify the instructor before or during the absence and must be able to supply relevant documentation as requested by the instructor. When these extended absences have been verified, instructors will suggest possible accommodations for these cases.

With the exception of extended technical problems originating in SaplingLearning system, there are no extensions on homework deadlines.

### *Exam absence*

Scheduled exam dates are provided in the course schedule. If you will miss an exam due to travel to/from an academic or professionally-related event, an MSU sponsored event or religious observance which can be anticipated in advance you must contact your instructor more than one week prior to the exam to determine if you are eligible for alternate exam arrangements.

If you unexpectedly miss an exam due to extenuating and unforeseen circumstances, such as significant illness or death of a loved one, you must contact your instructor within 24 hours of the missed exam.

In order to be considered for make up exam arrangements it is your responsibility to provide adequate documentation as requested by the instructor. You may or may not be eligible for a make up exam based solely on the discretion of the instructor(s). If the instructor determines that you are not

eligible for alternate exam arrangements and you do not/did not take the exam, you will earn a 0 on the exam.

For grief absences students must notify the Associate Dean or designee of their college of the need for a grief absence and must provide appropriate verification. The associate dean or designee will work with the student to determine the length of the absence and will notify faculty of the absence period. The policy on grief absence is described here: <https://reg.msu.edu/ROInfo/Notices/GriefAbsence.aspx>.

Make-up exams are administered at the instructor's convenience, typically within 48 hours of the original exam and may be scheduled without consulting students. Make-up exams typically consist of essay and calculation questions but instructors retain the right to offer multiple choice makeup exams or exams of mixed formats in some circumstances.

## Grading Criteria

This grading scale shows the percentage you must earn at the end of BMB462 to guarantee a particular grade. Your overall course grade percent will be rounded to the nearest tenth. Grades for graduate students will be determined from the undergraduate distribution.

### *Honors option*

Students may elect to take BMB461 with an H-option provided they obtain a grade of 3.0 or higher in the course. The honors option consists of a term paper that address an unsolved biochemical question related to a topic and research article provided by the instructors. Students interested in the honors option should check D2L during the first week of class for more information and deadlines.

### *Attendance policy*

This course follows the General University Attendance Policy (see <https://ombud.msu.edu/classroom-policies/>). Attendance itself is not a required component of the course, although students that attend class regularly perform better in the course and students are able to earn in-class clicker points on every non-exam day. If you miss a class, it is expected that students learn the material covered in class that day on their own. See the Make-Up Policy section for information about missing graded assessments.

Grade	Percentage
4.0	≥ 80.0
3.5	≥ 74.0
3.0	≥ 67.0
2.5	≥ 60.0
2.0	≥ 53.0
1.5	≥ 44.0
1.0	≥ 37.0
0.0	< 37.0

## Course Management Software

We will use D2L to post lecture handouts, lecture recordings, grades, and other general course information. We will use the news feature and the e-mail feature in D2L to provide information about the course. It is expected that students are regularly checking D2L for updates about the course.

SaplingLearning will be used for online homework assignments. There are help resources within this system to help you learn how to use and navigate the assignments. More information about how to register for the system will be delivered during the first week of class.

## Resources

This course extensively uses Desire2Learn (D2L) for the posting of lecture material. Students are expected to check these sites regularly for newly posted material. As members of a learning community, students are expected to respect the intellectual property of course instructors. All course materials presented to students are the copyrighted property of the course instructor. As such you may not post the recordings or other course materials online or distribute them to anyone not enrolled in the class without the advance written permission of the course instructor and, if applicable, any students whose voice or image is included in the recordings. Any student violating this restriction may face academic disciplinary sanctions.

### *Lecture Notes*

Lecture notes will be posted on D2L in advance of the lectures. These notes contain most figures discussed during lecture and are designed to aid your note taking during lecture and while reading the text. They are not a substitute for reading the textbook. It is highly recommended that you print these lecture notes and read the assigned reading in the text prior to lecture, taking notes while you read. Then bring your notes to lectures to help fill in areas that were confusing to you when you first read them in the text.

### *Course Recordings*

When possible, audio-video recordings of the lectures will be provided on D2L. The purpose of these recordings is to allow review of lectures as you study. **BMB 461 is not an online course**, and these recordings are not a substitute for attending lectures and taking notes. **You should not depend on these recordings:** some lectures may not be available or may be of poor quality due to technical difficulties. In such cases, there will be no recording posted. In addition, it is at the instructor's discretion to turn on the recording only after announcements regarding exams, etc. have been made.

### *Previous Exams*

Exams from a few previous semesters will be posted on D2L. Please note that some of these exams may be from semesters when exam policies or course schedule differed from the current semester. The exam keys will be posted no later than three days prior to each exam date.

### *Instructor review sessions*

There will be scheduled exam review sessions led by a course instructor before each scheduled exam. These review sessions take the form of "question and answer" sessions, where students should come prepared to ask questions about course material. The exact dates, times and locations of these review sessions will be announced before each exam.

### *Extra course help*

Students are strongly encouraged to use the optional TA-led review sessions, instructor-led exam review sessions and visit the regularly scheduled office hours for help in the course. For students desiring additional help, potential course tutors can be found at:

<https://bmb.natsci.msu.edu/undergraduate/tutoring/> .

## Accommodations

Michigan State University is committed to providing equal opportunity for participation in all programs, services and activities. Requests for accommodations by persons with disabilities may be made by contacting the Resource Center for Persons with Disabilities at 517-884-RCPD or on the web at [rcpd.msu.edu](http://rcpd.msu.edu). Once your eligibility for an accommodation has been determined, you will be issued a Verified Individual Services Accommodation ("VISA") form. Please present this form to Prof. Haudek at the start of the term and/or two weeks prior to the accommodation date. Requests received after this date may not be honored.

## Academic Honesty

[The Spartan Code of Honor](#) states, "As a Spartan, I will strive to uphold values of the highest ethical standard. I will practice honesty in my work, foster honesty in my peers, and take pride in knowing that honor is worth more than grades. I will carry these values beyond my time as a student at Michigan State University, continuing the endeavor to build personal integrity in all that I do." In addition, Article 2.III.B.2 of the [Student Rights and Responsibilities \(SRR\)](#) states that "The student shares with the faculty the responsibility for maintaining the integrity of scholarship, grades, and professional standards." This course adheres to and strictly enforces the policies on academic honesty as specified in General Student Regulations 1.0, Protection of Scholarship and Grades; the all-University Policy on Integrity of Scholarship and Grades; and Ordinance 17.00, Examinations. (See [Spartan Life: Student Handbook and Resource Guide](#) and/or the MSU Web site: [www.msu.edu](http://www.msu.edu).)

Therefore, unless authorized by your instructor, you are expected to complete all course assignments, with the exception of homework and in-class clicker questions, without assistance from any source. Students who violate MSU academic integrity rules may receive a penalty grade, including a failing grade on the assignment or in the course. *Using multiple clickers to send in answers for classmates who are not present is considered academic dishonesty.*

## SIRS

Michigan State University takes seriously the opinion of students in the evaluation of the effectiveness of instruction, and has implemented the SIRS (Student Instructional Rating System) process to gather student feedback. This course utilizes the "online SIRS" system, and you will receive an e-mail sometime during the last two weeks of class asking you to fill out the SIRS at your convenience. As a reminder to be sure to fill out the SIRS evaluation form, the final grade for this course will not be accessible on STUINFO during the week following the submission of grades for this course unless the SIRS online form has been filled out. You have the option on the online SIRS form to decline to participate in the evaluation of the course.



Date	Lec. #	Topic	Reading Pages	Instructor
30-Aug	1	Aqueous solutions and pH & buffers; acid/base problems	45-70	Hoogstraten
1-Sep	2	Amino acids and peptides	75-89	Hoogstraten
4-Sep	<b>Labor Day – University Closed</b>			
6-Sep	3	Proteins: Primary structure & evolution; <b>Clicker exercise 1</b>	96-97; 104-109	Hoogstraten
8-Sep	4	Proteins: Secondary structure	115-125	Hoogstraten
11-Sep	5	Proteins: Three-dimensional structure; <b>Clicker exercise 2</b>	125-142	Hoogstraten
13-Sep	6	Proteins: Structure and Folding	142-151	Hoogstraten
15-Sep	7	Protein purification	89-96	Hoogstraten
18-Sep	8	Protein-ligand binding: Myoglobin and hemoglobin	157-174	Hoogstraten
20-Sep	9	Enzyme catalysis and mechanism	187-198	Hoogstraten
	Optional Q and A by Instructor:			
22-Sep	<b>Exam I: Lectures 1-9 ONLY</b>			
25-Sep	10	Enzyme catalysis and mechanism	213-225	Hoogstraten
27-Sep	11	Enzyme kinetics: Introduction	198-206	Hoogstraten
29-Sep	12	Enzyme kinetics: Inhibition	206-213	Hoogstraten
2-Oct	13	Enzyme kinetics: Regulation and allostery; <b>Clicker exercise 3</b>	225-236	Hoogstraten
4-Oct	14	Enzymology and medicine: The cytochrome P450 system	822-823	Hoogstraten
6-Oct	15	Bioenergetics: Principles	491-507	Hoogstraten
9-Oct	16	Bioenergetics: High-energy compounds and phosphoryl transfer; <b>Cl. Exer 4</b>	507-517	Hoogstraten
11-Oct	17	Bioenergetics: Redox reactions and energy balance	517-526	Hoogstraten
	Optional Q and A by Instructor:			
13-Oct	<b>Exam II: Lectures 10–17 ONLY</b>			
16-Oct	18	Carbohydrates: I	241-252	Haudek
18-Oct	19	Carbohydrates: II	252-267	Haudek
20-Oct	20	Intro to metabolism	491-493; 533-538	Haudek
23-Oct	21	Glucose metabolism: Glycolysis I	534-548	Haudek
25-Oct	22	Glucose metabolism: Glycolysis II; <b>Clicker exercise 5</b>	540-553	Haudek
27-Oct	23	Glucose metabolism: Fermentation	553-558	Haudek
30-Oct	24	Glucose metabolism: Gluconeogenesis; <b>Clicker exercise 6</b>	558-565	Haudek
1-Nov	25	Glucose metabolism: Pentose phosphate pathway	565-570	Haudek
3-Nov	26	Pyruvate dehydrogenase complex	619-624	Haudek
6-Nov	27	Citric acid cycle	624-640	Haudek
8-Nov	28	Citric acid cycle and Glyoxylate cycle	640-642; 800-802	Haudek
	Optional Q and A by Instructor:			
10-Nov	<b>Exam III: Lectures 18-28 ONLY</b>			
13-Nov	29	Mitochondrial electron transport I	711-728	Ducat
15-Nov	30	Mitochondrial electron transport II	711-728	Ducat
17-Nov	31	Oxidative phosphorylation I	728-744	Ducat
20-Nov	32	Oxidative phosphorylation II	728-744	Ducat
22-Nov	33	Glycogen metabolism	601-607	Ducat
24-Nov	<b>Thanksgiving Break – University Closed</b>			
27-Nov	34	Regulation: Glycolysis, gluconeogenesis and glycogen; <b>Cl. Ex. 7</b>	575-584; 589-600	Ducat
29-Nov	35	Regulation: Glycolysis, gluconeogenesis and glycogen	608-614	Ducat
1-Dec	36	Photosynthesis: Light-driven ATP synthesis I	755-779	Ducat
4-Dec	37	Photosynthesis: Light-driven ATP synthesis II	755-779	Ducat
6-Dec	38	Photosynthesis: Carbon fixation I; <b>Clicker Exercise 8</b>	780-800	Ducat
8-Dec	39	Photosynthesis: Carbon fixation II	780-800	Ducat
	Optional Q and A by Instructor:			
14-Dec	<b>Exam IV (Lec 29-39) + Cumulative Final; 7:45-9:45 a.m. C102 Wilson</b>			